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MODEL BASED RECONFIGURABLE UNMANNED SYSTEM USING DISCREATE EVENT SYSTEM FORMALISM

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ABSTRACT

An unmanned system is widely used in various fields of society. To develop a service using unmanned systems, a developer should understand the hardware and software of the systems. However, the developers may not develop a service quickly since they cannot have all the knowledge. This paper proposes a model-based reconfigurable unmanned system using discrete event system formalism. The proposed system supports the modeling of control command sequences using the discrete event system formalism and implements it as a simulation model with a hardware controller. Therefore, the system may reuse models and reconfigure them to control unmanned systems easily.

1 INTRODUCTION

With the recent development of robotic technology, unmanned systems such as UAV (Unmanned Aerial Vehicle), UUV (Unmanned Underwater Vehicle), and UGV (Unmanned Ground Vehicle) have expanded the scope of their activities to do things that humans could not do. This study proposes a method to easily control and manage unmanned systems using DEVS(Discrete Event System) formalism. Since an unmanned system can be defined as a discrete event system, this research defines a command structure as DEVS models and executes them to control the real unmanned system. Especially the proposed method separates control structures and hardware-specific modules, so a developer may reuse the control structures by changing the hardware-specific module. Since the hardware-specific module sends the specific control signal to the system, the simulation engine may control various types of unmanned systems by changing the hardware-specific interface. Also, a developer may use simulation models to manage multiple unmanned systems simultaneously by configuring and reusing the existing DEVS model.

2 PROPOSED SYSTEM

The proposed system manages a reconfigurable unmanned system using the DEVS formalism. DEVS formalism expresses the target system as an atomic model represented by state transitions according to input events and state transitions according to time-out events. Also, it constructs a combined model using multiple atomic models. The proposed reconfigurable unmanned system can control the unmanned system by changing the control model according to the type and function of the target unmanned system using a model based on the discrete event system formalism and a simulation engine configuring it as a simulation model. Figure 1 shows the proposed model-based reconfigurable unmanned system.

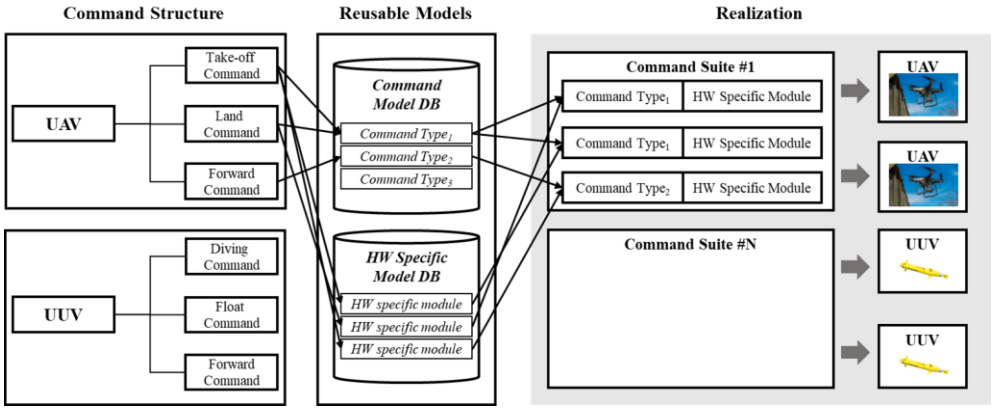

Figure 1: Model based Reconfigurable Unmanned System.

The proposed system first defines the command structure of an unmanned system. The command structure contains the essential commands of an unmanned system. Each command may correspond to a simulation model in the command model database. Also, each command model may utilize the hardware-specific module to send exact command signals to the unmanned system. Each command type model is defined as an Atomic model (Zeigler et al. 2000). Figure 2 shows an example of configuring the command system.

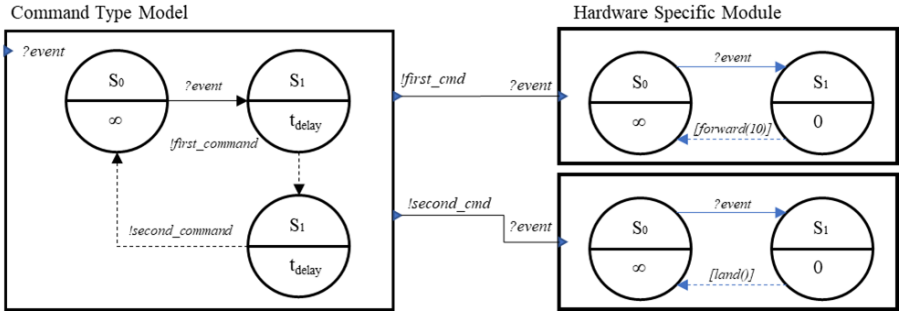

Figure 2: Example of the configured command.

Figure 2 shows the configured simulation model that generates a specific command sequence. The left side of the figure shows the command type. After the command type receives the event, the model triggers the first command after t_delay time. Then the hardware-specific module sends the command signals to the unmanned system. After the command, the command type model waits for the t_dealy time and sends the second command. This research used EventSim to implement the proposed system (EventSim).

ACKOWLEDGMENTS

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EventSim :available on https://github.com/eventsim/evsim. Accessed 12th January 2022.